Synopsis of Proposed Research Work

Entitled

"SOME OPTIMIZATION TECHNIQUES IN FUZZY TRANSPORTATION PROBLEM"

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By

Mr. Kaushik Anandrao Joshi
M.Sc., B.Ed., M. Phil.
Assistant Professor
Prof Ram Meghe College of Engineering & Management,
Badnera, Amravati.

Under the Guidance of,

Dr. Pandit U. Chopade
M. Sc., Ph. D., SET
Assistant Professor,
Department of Mathematics
Dnyanopasak Shikshan Mandal's College of Arts, Commerce and Science, Jintur

Research Center

Department of Mathematics
N. E. S. Science College, Nanded

Abstract of proposed work plan

"Some Optimization Techniques in Fuzzy Transportation Problem"

1. Introduction

Optimization is the act of achieving the best possible result under given circumstances. In design, construction, maintenance, engineers have to take decisions. The goal of all such decisions is either to minimize effort or to maximize benefit. The effort or the benefit can be usually expressed as a function of certain design variables. Hence, optimization is the process of finding the conditions that give the maximum or the minimum value of a function.

The concept of optimization has great significance in both human affairs and the laws of nature which is the inherent characteristic to achieve the best or most favorable (minimum or maximum) from a given situation. In addition, as the element of design is present in all fields of human activity, all aspects of optimization can be viewed and studied as design optimization without any loss of generality. This makes it clear that the study of design optimization can help not only in the human activity of creating optimum design of products, processes and systems, but also in the understanding and analysis of mathematical/physical phenomenon and in the solution of mathematical problems. The constraints are inherent part if the real world problems and they have to be satisfied to ensure the acceptability of the solution. There are always numerous requirements and constraints imposed on the designs of components, products, processes or systems in real-life engineering practice, just as in all other fields of design activity. Therefore, creating a feasible design under all these diverse requirements/constraints is already a difficult task, and to ensure that the feasible design created is also 'the best' is even more difficult.

Business and Industries are practically faced with both economic optimizations such as cost minimization of non-economic items that are vital to the existence of their firms. The transportation models or problems are primarily

concerned with the optimal (best possible) way in which a product produced at different factories or plants (called supply origins) can be transported to a number of warehouses or customers (called demand destinations). The objective in a transportation problem is to fully satisfy the destination requirements within the operating production capacity constraints at the minimum possible cost. Whenever there is a physical movement of goods from the point of manufacturer to the final consumers through a variety of channels of distribution (wholesalers, retailers, distributors etc.), there is a need to minimize the cost of transportation so as to increase profit on sales.

2. Review of Literature and Development in the subject (Previous work done in the relevant area):

The basic transportation problem was originally developed by Hitchcock (1941). Efficient methods of solution are derived from the simplex algorithm and were developed in 1947. Charnes et al (1954) developed the Stepping Stone Method which provides an alternative way of determining the simplex-method information. George B. Dantzig (1963) used the simplex method in the transportation problem as the Primal simplex transportation method. An initial basic feasible solution for the transportation problem can be obtained by using the North West corner rule, Row minima, Column minima, Matrix minima, or the Vogel's approximation method. The Modified Distribution method is useful for finding the optimal solution for the transportation problem. After the introduction of Fuzzy mathematics by Lotfi Zadeh (1965) many scientist got a new direction to apply the fuzzy theory to optimization and in particular transportation problem. Unlike most philosophical theories of vagueness, Zadeh's engineering approach had the advantage that it could be directly applied to computer programming.

Zimmermann (1978) applied the fuzzy set theory concept with some suitable membership function to solve multi-objective transportation problems. Arsham et al (1989) introduced a new algorithm for solving the transportation problem.

Transportation Problem:

Let us consider that there are m sources and n destinations. Let x_{ij} be the amount to be shipped from source i to destination j, $1 \le i \le m$, $1 \le j \le n$. x_{ij} will be an integer greater than, or equal to, zero. Also let a_i be the amount of supply at source $i = 1, ..., m$ and b_j the demand at destination $j = 1, ..., n$. The unit Transportation cost from source i, to destination j is c_{ij}, $1 \le i \le m$, $1 \le j \le n$.

The linear programming model is

$$Minimize\ Z = \sum_{i=1}^{m} \sum_{j=1}^{n} C_{ij} x_{ij}$$

subject to

$$\sum_{i=1}^{m} x_{ij} \ge b_j \quad j = 1, 2, 3, ...n$$

and

$$\sum_{j=1}^{n} x_{ij} \le a_i \quad i = 1, 2, 3, ...m$$

where $x_{ij} \ge 0$ and x_{ij} integer.

For the model to be feasible we must have the total supply is at least equal to the total demand

$$\sum_{i=1}^{m} a_i \ge \sum_{j=1}^{n} b_j$$

3. Objectives of Research/ Proposed Hypothesis:

1. Solve the transportation problem with the regular methods available such as NWCM, LCM and VAM for initial basic feasible solution. Find the optimal solution by Modified distribution method.
2. Convert crisp transportation problem to fuzzy transportation problem by using

fuzzy numbers and try to find the Initial Basic Feasible Solution and Optimum Solution.

3. Apply MATLAB or any Scientific Tool to solve both the Crisp and Fuzzy Transportation Problem.
4. Try to investigate some properties of the solutions existence, uniqueness and other of fuzzy transportation problem.
5. Try to apply the transportation problem analysis to the various fields of day to day life, Business and Technology.

4. Methodology to be adopted:

1. Collection of relevant literature from good libraries in India and abroad.
2. Solution of transportation problem by regular methods.
3. Conversion of the regular transportation problem (Crisp) to fuzzy transportation problem.
4. Use of MATLAB or any scientific tool available for the solution of both Crisp and Fuzzy transportation problem.
5. Consultations with expertise on topics relevant to proposed work.
6. Publishing original work.

5. Importance of study/ Society application:

In this proposed work our main focus is to apply the optimization techniques for the determination of the solution of transportation problem. In real life we may face many complex equations while constructing the transportation problem and fuzzy linear programming problem. Use of MATLAB or any other scientific tool will provide an easy access for such complex equation and can generate approximate solutions.

- **International status**

1. **Kenan Karagul and Yusuf Sahin (2019)** found a novel approximation method is proposed to create an efficient IBFS to transportation problem which is an important problem in the field of optimization. The method, built on a heuristic structure, differs from the previous methods in that it takes into account the supply – demand coverage ratio (weights) as well as the cost.
2. **Ali Ebrahimnejad (2016)** proposed a new method for solving fuzzy transportation problems (FTPs) in which the transportation costs and supply and demand are represented by non–negative *LR* flat fuzzy numbers. The fuzzy transportation problem is converted into four transportation problems, which are solved using standard transportation simplex algorithms.
3. **A.R. Khan (2012)** solved the transportation problem for initial solution by the algorithmic approach and developed an algorithm followed by a C program. Further he used 'TORA Optimization System' software for the optimal solution.
4. **J. Buckley and Leonard J. Jowers (2006)** developed 'Monte Carlo Method in Fuzzy Optimization' which gives very detailed information about fuzzy optimization techniques. They introduced Monte Carlo method to find proper approximate solutions to fuzzy optimization problems.
5. **Kikuchi (2000)** suggested that, in many problems of transportation engineering and planning, the observed or derived values of the variables are approximate.

- **National Status**

1. **Prabhjyot Kaur (2019)** studied of two stage transportation and assignment problems using combinatorial optimization and concave minimization.
2. **Maulik Patel and Achyut C. Patel (2018)** studied the multi objective transportation problem with restrictions.

3. **A. S. Mhaske, K. L. Bondar (2017)** applied Monte Carlo method for the solution of Fuzzy Transportation Problem.
4. **Manmath Lohgaonkar, Vishnudas Bajaj, VA Jadhav, MB Patwari (2015)** present a fuzzy multi-objective multi-index transportation problem and develop multi-objective multi-index fuzzy programming model.
5. **Amit Kumar, Amarpreet Kaur (2011)** applied Classical Transportation Methods for Solving Fuzzy Transportation Problems.
6. **Debashis Dutta and A. Satyanarayana Murthy (2010)** applied multi-choice Goal Programming approach for a Fuzzy Transportation Problem.
7. **A. Nagoor Gani and K. Abdul Razak (2006)** converted crisp transportation problem to fuzzy transportation problem by using trapezoidal fuzzy number. They considered fuzzy transportation problem in which supplies and demands are trapezoidal fuzzy numbers. A parametric approach is used to obtain a fuzzy solution.

- **Significance of the study**

The aim of this work is to study the optimization techniques for the solution of the transportation problem. Further we would like to introduce the fuzzy transportation problem and apply the scientific tools like MATLAB or other for the solution. The proposed method attempts to minimize the total cost of transportation along with the total delivery time with reference to constraints of available supply and future demand. In real world transportation planning, decision problems, input data and related parameters, such as available supply and future demand, are often imprecise because some information may be incomplete or unobtainable. In this case the scientific tools will help us to solve such problems with complex equations.

7. Proposed work Plan/ Formulation and Structure of Study:

Year-wise Plan of work and targets to be achieved

Sr. No	Year	Plan of work/Expected target to be achieved
1.	First Year	In Depth analysis of the problem and the literature search for the Optimization Techniques for Transportation Problem.
		Find the solution of the transportation problem and Introduction of Fuzzy Transportation Problem.
2.	Second Year	Convert regular transportation problem into fuzzy transportation problem. To generate Fuzzy Numbers.
		Solve the fuzzy transportation problem by using fuzzy numbers.
3.	Third Year	To apply the scientific tool for the transportation and fuzzy transportation problem.
		Result, Comparison, Discussion and conclusion, Publication about project work.

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Mr. Kaushik A. Joshi
Research Scholar

Dr. Pandit U. Chopade
Research Guide